

Energy Storage Incentive Rate Setting for States

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Summary

The intent of this document is to provide recommendations and guidance for states seeking to develop distributed or behind-the-meter (BTM) energy storage incentive programs. It is intended to help states decide how to structure incentive programs and how to set incentive rates.

As states increasingly adopt energy storage targets, develop storage policy and regulation, and seek to drive energy storage deployment, numerous incentive programs have emerged. These vary greatly in design, making it difficult to compare incentive rates from one program to another. For example, some incentive programs offer rebates, while others provide performance payments over a fixed period. Other programmatic differences, such as customer vs. utility ownership of BTM batteries, contribute to the difficulty of making apples-to-apples comparisons across programs.

In order to create a common basis for comparison, the authors necessarily made some assumptions (for example, in evaluating performance payment incentive programs, we assumed perfect battery performance and a services contract duration of 10 years). Nevertheless, all possible variables could not be accounted for in comparing different state programs. Furthermore, total incentive calculations were kept simple (e.g., the net present value of future incentive payments was not considered). For these reasons, the recommendations that follow should be seen as a rough guide to current incentive rates in states that have established battery incentive programs.

FINDINGS

- **Incentive rates:** At the time of this report, average residential/small commercial energy storage incentive rates for the state programs examined ranged from \$350/kWh to \$1,333.33/kWh, with a mean rate of \$805/kWh.
- **Incentive mechanisms:** In order to maximize both customer uptake and grid value, programs should combine up-front and performance-based incentives.
- **Financing:** Several states offer low- or no-cost financing. This is especially critical to provide access for income-qualifying customers and historically underserved communities. While many energy storage developers also offer financing, it can be helpful for a state to provide public financing options (for example, low- or no-interest loans that do not require high credit scores to qualify).
- **Role of developers/aggregators:** Developers and aggregators should be encouraged to participate in state energy storage incentive programs. Allowing developers/aggregators to enroll customers into state incentive programs offers numerous advantages. For example, aggregators can help market the program, provide financing services to customers, offer leasing options, and bundle complete systems, such as combined solar+storage offerings.

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- Equity: Equity provisions in energy storage incentive programs are important to enable underserved communities and low-income customers to participate. States should consider equity provisions during the program development phase, rather than adding them after programs are established. To ensure equity provisions will be effective, the authors recommend that states seek stakeholder input from community-based organizations that focus on environmental and energy justice. Examples of energy storage equity provisions include the following:
 - Justice40 commitment/carve-out
 - Adders for income-eligible participants and commercial entities serving historically underserved communities
 - Front-loaded incentive payments for income-eligible participants
 - Pre-development technical assistance to determine technical and economic feasibility and project optimization
 - Optional on-bill financing
 - Community benefits requirement
 - Incentives for owned and leased systems

METHODOLOGY USED IN THIS ANALYSIS

These recommendations are based on a rough average of several state program incentive rates, converted to a common dollars-per-kilowatt basis. Note that not all state incentive programs can be directly compared apples-to-apples because of differing program structures. For example, the California Self Generation Incentive Program (SGIP) offers a 50 percent upfront rebate combined with a 50 percent performance-based payment, while the ConnectedSolutions program in Massa-chusetts, Rhode Island, and Connecticut offers performance payments only; and the Massachusetts SMART program offers energy storage adders to solar rebates (with the size of the adder based on capacity of the associated solar PV). Several pilot programs have offered free battery storage. In order to produce a useful recommendation, the authors eliminated from analysis outlier programs (such as free battery pilots) and those that are too dissimilar in structure for comparison (such as battery adders in solar incentive programs). For performance-based incentive programs, we assumed consistent performance incentive rates awarded over a standardized battery life of 10 years (NPV of future payments was not considered); battery performance was assumed to be optimal. For declining block structures, we used the initial (block 1) rate. Program details and examples of rate calculations can be found in the Appendix.

CAVEAT

This report focuses on incentive rate setting for state energy storage programs. However, it is important to note that incentive rates alone are not predictive of program outcomes, and a high rate cannot guarantee success. Energy storage economics can be complex, and incentive rates are only one of many variables that determine the economic feasibility of installing energy storage.

Energy Storage Incentive Rate-Setting Considerations

INTRODUCTION TO ENERGY STORAGE INCENTIVES

Historically, states have used incentive programs to support the deployment of many clean energy technologies, such as solar PV, wind energy, energy efficiency measures, combined heat and power (CHP), and sustainable biofuels. To date, energy storage incentive programs have tended to employ elements that will be familiar from these previous programs—that is, they tend to use some combination of rebates, performance incentives, financing, carve-outs, adders, and other well-established clean energy policy measures.

The design of incentive programs should generally follow from state clean energy policy goals. In other words, clean energy incentive programs exist to help the state attain its clean energy goals, and the design of any particular incentive program should reflect this. For example, if the state has set a goal of reducing greenhouse gas (GHG) emissions in the electricity sector, it might establish a program that incentivizes energy storage resources to charge from the grid when there is a surplus of solar generation and discharge at times when high-emitting fossil generators are on the margin, thereby displacing high-emissions generation. If, however, the state's policy goal is to reduce the use of gas and oil for home heating, it might incentivize home solar+storage systems installed in tandem with building electrification measures to replace existing gas and oil heating systems.

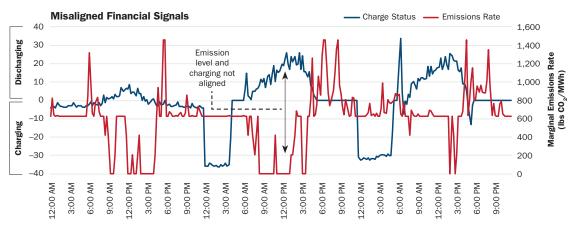
Unlike some other clean energy technologies, energy storage is a multi-use resource, meaning it can serve different purposes depending on how it is used. Therefore, the design of storage incentive programs can be very important. An energy storage incentive that is not directly linked to the use of the technology may not result in the desired outcomes.

An example of this is provided by the California Self Generation Incentive Program (SGIP), which was intended to support the state's GHG emissions reduction goals. Initially, the SGIP battery incentive provided a rebate for battery installation but did not prescribe or reward any specific use of the batteries once they were installed. Analysis showed that this approach failed to result in a decrease in GHG emissions—in fact, emissions increased under the program. In order to rectify this, the program was changed so that customers received only half the incentive in the form of a rebate, with the other half awarded for battery performance (customers had to charge from the grid during low-emission periods and discharge during high-emission periods). This achieved the desired result, with GHG emissions decreasing once incentives were aligned with the desired emission outcomes (see Figure 1a, page 5 and Figure 1b, page 6).

Until battery prices fall, energy markets mature, and currently non-monetizable energy storage services become monetizable, state incentives will be a necessary and critical key to increasing energy storage deployment.

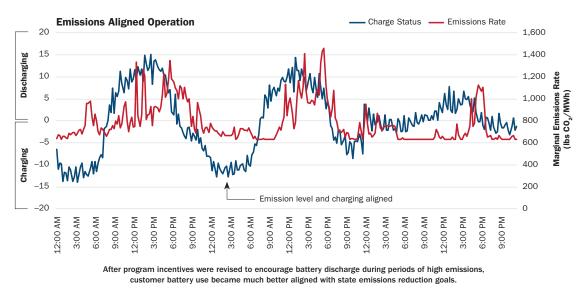


Figure 1a SGIP Emissions Alignment Before and After Incentives were Aligned with Goals



The California SGIP program initially suffered from financial signals that were not aligned with state emissions data. As a result, battery owners frequently discharged their batteries during low emissions periods, rather than charging when emissions were low and discharging when they were high.

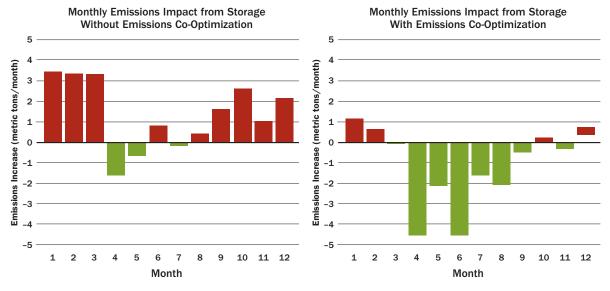




Source: WattTime



Figure 1b Emissions Impacts Before and After Incentives Were Aligned with Goals



California solved its energy storage emissions problem by making 50% of the SGIP battery incentive contingent on customers charging and discharging their batteries at the right times. As a result, customer batteries went from being part of the state's emissions problem, to being part of the solution.

Below are several key topics for states to consider as they develop or update battery storage programs and incentives.

TYPES OF INCENTIVES

The energy storage incentive programs considered in this report fall into three categories:

- 1. Rebates (payment for installing storage)
- 2. Performance incentives (payment for storage services provided to a utility or grid operator)
- 3. Combined rebates and performance incentives (an up-front payment for installing storage coupled with ongoing, periodic payment for storage services)

Various other program elements, such as low- or no-cost financing and on-bill payment options, have been used in combination with these incentive structures to support equity goals and income-eligible participation in some states.

In addition to the above, there are other types of energy storage incentives that have been tried. For example, storage may be added to existing renewable programs, such as solar incentive programs, or be made eligible for market-based programs such as utility renewable portfolio standards (RPS). Some pilot programs have even proposed giving free batteries to low-income customers. Because of the difficulty of making these other types of programs comparable to more straightforward incentives, they are not included in the comparisons for this report.

INCENTIVE RATES AND COMPARISONS

This report provides an incentive rate comparison of several similarly structured state energy storage incentive programs. Comparable programs considered for this report include the Connecticut Energy Storage Solutions program, the Massachusetts and Rhode Island Connected-Solutions programs, the California SGIP program, and the New York Bridge Incentive Program. Individual program rates are summarized in the Appendix. (Note that for declining block programs, the initial (block 1) rate is used. Currently available rates may differ.)

Comparing the program structures and rates from these state energy storage programs yields the following conclusions:

- State energy storage incentive programs vary greatly in both program structures and incentive rates. The differences in structure—for example, rebates vs performance payments —make it very difficult to make apples-to-apples comparisons from state to state.
- It is difficult to establish consistent parallels between rates and outcomes. For example, New York offers relatively low per-kWh incentive rates, but its programs are nearly fully subscribed. By contrast, Connecticut offers relatively high incentive rates but its residential program has been under subscribed.
- Incentive rates alone do not convey a comprehensive economic story for energy storage in a state. For example, it is easier in some regions than in others for distributed storage to sell services into regional wholesale energy markets (and in non-ISO/RTO areas, wholesale energy markets may not even exist). Also, state energy storage incentive programs may be bolstered in some cases by other state or utility programs (for example, in Massachusetts energy storage owners may enroll in the ConnectedSolutions program while simultaneously benefitting from SMART solar+ storage incentives and Clean Peak Standard credits).
- While cost savings and revenues are significant drivers of program uptake, they are not the only drivers. For example, studies have shown that for a majority of residential customers, back-up power is the primary motivation for purchasing a battery storage system.
- A range of barriers may significantly reduce program uptake, even where incentive rates are relatively high. These can include interconnection-related costs and delays, supply chain-related costs and delays, permitting and siting barriers, exclusive wholesale energy market rules, a lack of low-cost financing for energy storage systems, ineffective program marketing, regulatory barriers, utility opposition and other barriers.
- Similarly, program uptake may be enhanced by factors unrelated to incentive rates, such as supportive utilities, storage-friendly regulations, effective marketing, active third-party developers and aggregators, and the availability of low- or no-cost financing.

- Despite all these variables, numerous studies as well as experience have shown that until energy markets mature, battery prices fall, and currently non-monetizable energy storage services become monetizable, state incentives are a necessary and critical key to increasing distributed storage deployment. Very few states have seen significant BTM energy storage uptake in the absence of incentive programs.
- At the time of this report, average residential/small commercial energy storage incentive rates for the state programs examined ranged from \$350/kWh to \$1,333.33/kWh, with a mean rate of \$805/kWh.
- State policymakers should consider combined up-front and performance-based incentives.
- Low/no-cost financing should be considered, especially for income-qualifying customers. While many energy storage developers offer financing, it can be helpful for the state to provide public financing options that can be marketed to income-qualified customers and historically underserved communities (for example, low- or no-interest loans that do not require high credit scores to qualify).
- Developers and aggregators can be very helpful in enrolling customers into state incentive programs. Aggregators can help market the program, provide financing services to customers, offer leasing options, and may also offer combined solar+storage systems to customers.
- Equity provisions should be considered during the program development phase, rather than after programs are established. The authors recommend that states seek stakeholder input from community-based organizations that focus on environmental and energy justice. Further discussion of equity provisions follows.

Equity in State Energy Storage Incentive Programs

In order to achieve an equitable outcome, it is important to consider equity goals and provisions when developing state energy storage incentive programs. As is often the case when new, clean energy technologies enter the market, those communities most in need of energy storage benefits are typically the communities that will find it hardest to access these benefits. For this reason, states are increasingly prioritizing equity considerations when developing storage incentive programs.

Although this may seem challenging from an economic perspective, examples of successful energy storage equity programs do exist, and best practices are beginning to emerge. Examples of energy storage equity provisions include the following:

• **Justice40 commitment/Carve-out**. Typically, a carve-out is necessary to ensure historically overburdened communities and income-eligible customers can participate in energy storage incentive programs. When sizing a carve-out, states may wish to consider adopting the Justice40 standard as recommended by the federal government. For more information see www.whitehouse.gov/environmentaljustice/justice40. For an example of a state program that has adopted this standard, see the Connecticut Energy Storage Solutions program at https://portal.ct.gov/pura/electric/office-of-technical-and-regulatory-analysis/clean-energy-programs/energy-storage-solutions-program.

- Adders for income-eligible participants and commercial entities serving historically underserved communities. Because a carve-out by itself is not sufficient to overcome the additional cost and risk barriers associated with equity projects, the authors recommend both a reserved capacity block and an additional incentive adder for historically underserved communities.
- Front-loaded incentive payments for income-eligible participants. The initial cost barrier to an energy storage project can be difficult or impossible to overcome for lower income communities, even with the promise of later payments or revenues; in addition, financiers often view future payments as riskier and of lower value than present payments. For these reasons the authors recommend fixed incentives/rebates be provided to equity projects up front and in full, and/or that a separate up-front equity incentive is provided to reduce the initial cost barrier.
- **Pre-development technical assistance to determine technical and economic feasibility and project optimization.** Grants for pre-development technical assistance allow equity projects to obtain technical-economic analysis which can help determine the feasibility of the project, as well as providing guidance on optimal system design, ownership structures and other key questions.¹
- **Optional on-bill financing.** This option can be useful for some equity customers and should be considered in combination with other financing options.
- **Community benefits requirement.** In order to support equity goals, energy storage projects must provide real benefits to the community in which the project is located and for the people it serves. The developers of equity energy storage projects should be required to demonstrate these benefits in their plans and confirm these benefits after projects are complete. Note that all benefits need not be monetary: increased energy independence, critical facility resilience, increased deployment of distributed solar PV, resilience for medically vulnerable/electricity-dependent households, workforce development and the retirement of polluting fossil fuel generators are examples of non-monetary benefits that may be important to local communities.
- **Incentives for owned and leased systems.** Owning clean energy resources increases property values and can provide important benefits related to energy independence. On

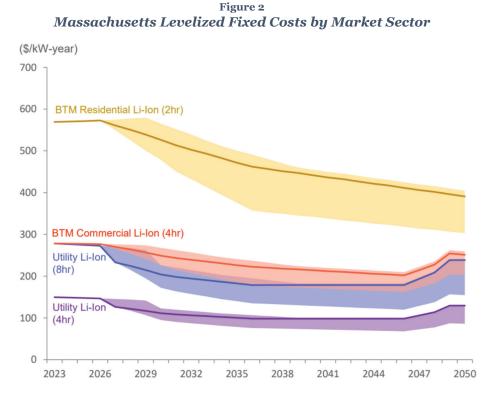
¹ Clean Energy Group's Technical Assistance fund (www.cleanegroup.org/initiatives/technical-assistance-fund) is a good model for pre-development technical support programs. Another program is the Washington State Solar plus Storage for Resilient Communities program (www.commerce.wa.gov/growing-the-economy/energy/ solar-plus-storage).

the other hand, battery leasing programs will likely play a significant role in scaling up distributed energy resources in markets where they are available and can be an important option for some customers. To provide the broadest set of options and make battery storage widely accessible, incentives should be offered for both owned and leased systems as well as other models, such as power purchase agreements and community storage models, that satisfy equity requirements.

Commercial vs. Residential Battery Incentives

When setting incentive rates, a question that commonly arises is whether to offer the same incentive rate to commercial and residential customers, or whether to offer different rates based on system size and/or ownership.

On a cost basis, there is a large difference between residential batteries and commercial batteries, with the residential systems being significantly more expensive per kilowatt (see Figure 2).



Source: E3 for Massachusetts Clean Energy Center and Massachusetts Department of Energy Resources

In addition to the lower per-unit cost for larger batteries due to economies of scale, commercial customers typically have a larger array of value streams available to them. For example, commercial customers can often realize energy cost savings through demand charge management and may be able to enroll larger batteries into utility demand response and/or wholesale energy market programs. By contrast, residential customers frequently cite resilience as their primary motivation for purchasing a battery, and they typically have few opportunities to monetize battery services, unless through a state- or utility-based performance incentive program. Residential customers may also have trouble monetizing the full value of federal energy storage tax incentives.

All this would argue for higher per-unit incentives for residential customers as compared with commercial customers. And in fact, many state incentive programs offer higher rates for residential and small commercial systems, and lower rates for large commercial/industrial systems.

Note, however, that residential customers often enjoy relatively low soft costs, because residential systems are fully commoditized and often come bundled with PV and related products such as financing and warrantees. By contrast, commercial and larger systems are typically designed to order for a specific site and optimized for specific applications. This entails project-specific design and engineering costs that are not borne by residential customers. Furthermore, larger commercial systems may require dedicated staff time for dispatch and maintenance; and larger systems are more frequently subject to expensive and time-consuming interconnection studies and associated grid upgrade costs.

At this writing, there is no consensus among state energy storage incentive programs as to the relative scale of rates offered to large- vs. small-scale energy storage systems. Ideally, rate-setting should be informed by many other variables (wholesale markets, barriers to adoption, the availability of other subsidies and the policy goals of the state), and for this reason each state will need to make this decision for itself.

APPENDIX

State energy storage program incentive rates and structures are summarized below.

Connecticut Energy Storage Solutions

Connecticut's Energy Storage Solutions program combines an up-front rebate with a performance incentive. It also incorporates significant equity provisions, such as a 2x up-front incentive multiplier for income-eligible residential participants. Multifamily affordable housing facilities are considered "residential," thus allowing them to qualify for the equity multiplier. This program has been very successful on the commercial side, becoming fully subscribed quickly following its launch. The residential program has been less successful, leading program administrators to raise the residential incentive rate (the new rates are reflected in Table 1 below). At this writing, it is too early to determine whether the residential rate increase will significantly improve residential uptake.²

Up-Front incentive: This requires enrolling a battery in the passive dispatch program. There is no performance incentive associated with passive dispatch. Upfront rebates reduce up to 50 percent of the battery's cost in exchange for allowing the battery to reduce electrical grid stress on hot summer days for 10 years.

Туре	Definition	Incentive Rate	Additional Info
Residential and Small Commercial	10 MW installed capacity	Step 1: \$250/kWh	Cap set at max of 50% or \$7,500 per battery
Residential Underserved	Households at or below 60% of the State Median Income	\$450/kWh	Includes MFAH, maximum incentive \$16,000
Residential Equity	A "distressed municipality," as designated by the CT Department of Economic and Community Development, or defined census block groups where 30% of the popu- lation is living below 200% of the federal poverty level	\$600/kWh	Maximum \$16,000
Residential Grid-Edge Adder	Customer that resides on the top ten percent of circuits with the longest and highest number of outages per customer curing major storms since $7/1/2012$	50%	Maximum \$16,000
Small Commercial	<200 kW	\$200/kWh	
Medium Commercial	200-500 kW	\$175/kWh	
Large Commercial	>500 kW	\$100/kWh	
Commercial Grid-Edge Adder	See Residential Grid Edge Adder definition	25%	

Table 1Up-Front Rebate Rates

2 As a result of a 2023 program review, residential customers saw their increased by 25 percent (from \$200/kWh to \$250/kWh), while disadvantage and low-income customers saw a 50 percent increase (from \$300/kWh to \$450/kWh for underserved communities, and from \$400/kWh to \$600/kWh for low-income customers). The 50 percent grid-edge adder sits on top of these rates. PURA also increased the residential upfront incentive cap from \$7,500 to \$16,000.

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Performance incentive: This requires enrolling the battery in an active dispatch program, which takes precedence when called over the passive dispatch schedule. Performance incentive rates are the same for residential and commercial customers. For purposes of calculation, a three-hour event duration is assumed (see Table 2).

	Years 1-5		Years 6-10	
Season	Summer	Winter	Summer	Winter
Incentive	\$200/kW	\$25/kW	\$115/kW	\$15/kW

 Table 2

 Performance Incentives

Residential/Small Commercial Total Incentives Calculation Example

(based on 10-year optimal performance) \$250/kWh up-front incentive + \$59.16/kW annual performance rate (average of winter and summer rates for years 1–5 and 6–10, divided by three-hour event duration) x 10 years = \$841.60/kWh

Additional resources regarding Connecticut

Energy Storage CT, "Energy Storage Solutions for Buildings & Communities," https://energystoragect.com/energy-storage-solutions-for-buildings-communities.

Energy Storage CT, "Cleaner, Quieter Energy for Your Home," https://energystoragect.com/ energy-storage-for-your-home.

Connecticut Department of Energy & Environmental Protections, "What is an Environmental Justice Community?" https://portal.ct.gov/DEEP/Environmental-Justice/05-Learn-More-About-Environmental-Justice-Communities.

Energy Storage CT, "Who qualifies as a low-income customer?" https://energystoragect.com/ low-income-verification.

Energy Storage CT, "Grid Edge Map Instructions," https://energystoragect.com/ grid-edge-map-instructions.

Massachusetts and Rhode Island ConnectedSolutions

The ConnectedSolutions program is similarly structured in Massachusetts and Rhode Island, but incentive rates differ by state (see Table 3). The Massachusetts program has been moderately successful, with good uptake in both the commercial and residential markets, although it lacks significant equity provisions and has a limited budget. The Rhode Island program has suffered due to the recent sale of the state's largest electric utility, which administers the program. Note that while neither program offers an up-front installation incentive, Massachusetts customers may be able to stack other battery incentives such as the SMART solar incentive with storage adder and the Clean Peak Energy Standard Program, which allows customers to generate valuable clean peak credits. Because ConnectedSolutions is part of the MassSave statewide energy efficacy plan, zero-interest HEAT loans are also available to customers wishing to purchase a battery and enroll in the program.

	Massachusetts	Rhode Island
Summer	\$275/kW	\$400/kW
Winter	\$25/kW	-
Total	\$300/kW	\$400/kW

Table 3
Small Battery Performance Incentives

Small battery incentive rate calculation example

Per-kW incentive averaged over 3-hour call x 5-year performance contract: Massachusetts: \$100/kW x 5-year contract = \$500/kWh Rhode Island: \$133.33/kW x 5-year performance contract = \$666.66/kWh

Total 10-year incentive assuming customer re-contracts for a second 5-year term: Massachusetts: \$1000/kWh Rhode Island: \$1,333.33/kWh

Additional resources for Massachusetts and Rhode Island

Mass Save, "Battery Storage," https://www.masssave.com/residential/rebates-and-incentives/battery-storage-and-evs/batteries.

Rhode Island Energy, "Battery Program," https://www.rienergy.com/RI-Home/ ConnectedSolutions/BatteryProgram.

California Self-Generation Incentive Program (SGIP)

The California SGIP provides up-front incentives for residential customers and a combination of up-front and performance-based incentives for large, non-residential customers (see Table 4).

The SGIP program has been very successful. However, the original equity program, which offered only a carve-out without incentive adders, was not successful in attracting subscribers. Once incentive adders were adopted, the equity budget quickly became fully subscribed. Note that the California program offers equity, resilience, and equity resilience adders; also, large storage claiming the federal Investment Tax Credit (ITC) receives a slightly reduced incentive.

Туре	Incentive Rate
Residential Up-Front	\$500/kWh
Non-residential resiliency	\$650/kWh
Residential equity	\$850/kWh
Equity resilience	\$1000/kWh
Large (non-residential)	\$500/kWh (half up-front, half annual performance payment over 5 years for dispatch optimized for GHG emissions)
Large storage claiming ITC	\$460/kWh

 Table 4

 California SGIP Incentive Rates

Additional resources for California

Customer Eligibility for the Equity Resiliency Budget, http://www.selfgenca.com/documents/handbook/2022.

Center for Sustainable Energy, Self-Generation Incentive Program Handbook, http://www.selfgenca.com/documents/handbook/2022.

New York Storage Market Acceleration Bridge Incentive Program

The New York Market Acceleration Bridge Incentive Program offers a fixed up-front incentive in a declining block structure, with rates based on nameplate capacity (see Table 5). Rates also vary in different areas of the state (the program offers different rates for customers in New York City, Long Island, and the rest of the state). For example, in the "Rest-of-state" region the Block 1 commercial incentives were \$350/kWh of storage capacity and declined to \$125/kWh in Block 4, while New York City's Block 4 incentive rate was \$100/kWh.

Most New York incentives are fully subscribed, with only a small budget remaining for Long Island residential incentives, block 2, at \$250/kWh.

Туре	Description	Incentive Rate
Retail storage	<5 MW	\$350/kWh for the first four hours of a system's duration, after which the rate is reduced by 50% for hours five and six. No incentive provided for storage capacity beyond six hours. Incentive capped at 15 MW
Bulk storage	5-20 MW	\$110/kWh
Bulk storage	>20 MW	\$85/kWh

Table 5
NY Storage Market Acceleration Bridge Incentive Rates

Additional resources for New York

NYSERDA, "Energy Storage," https://www.nyserda.ny.gov/All-Programs/Energy-Storage-Program.

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